AbstractID: 13299 Title: Sensitivity Analysis of Geometric Calibration Method using Projection Matrices for Tomographic Imaging Systems with Flat Panel Detectors

Purpose: To evaluate the sensitivity of geometric calibration method using projection matrices for tomographic imaging systems with flat-panel detectors. **Method and Materials:** A generic geometric calibration method for tomographic imaging systems has been presented in our previous work. The method involved a scan of a calibration phantom with multiple markers. The markers' locations in projection images were detected, and were associated with their 3D coordinates to compute 3×4 projection matrices, which could be used in subsequent image reconstruction. This work analyzed sensitivity of the calibration method by changing marker numbers and corrupting marker locations with Gaussian noises. A 6cm CIRS breast research phantom and a prototype breast tomosynthesis system were utilized for experiments. A high contrast ring object and two small speck groups were reconstructed in various testing cases for comparison. In order to achieve quantitative assessment, a 15×15 point detection mask was adopted for detecting signals and for computing degradations of testing cases from standard system calibration in terms of signal percentages. **Results:** When marker locations were accurate, all tested cases of marker numbers resulted in similar accurate reconstructions of the ring object and speck groups. Inaccurate marker information caused image distortion. Signal might be enhanced or decreased depending on specific errors occurred in geometric calibration. Speck groups were more affected than the ring. Errors in projected marker locations could result in drastic image degradation. With larger marker numbers, effect of errors in 3D marker positions might not be reduced, but impact of errors in 2D marker locations could be greatly reduced. **Conclusion:** 28 or more markers are desired for practical geometric calibration phantom design. Their detections in projection images are crucial for accurate image reconstruction using the computed projection matrices.